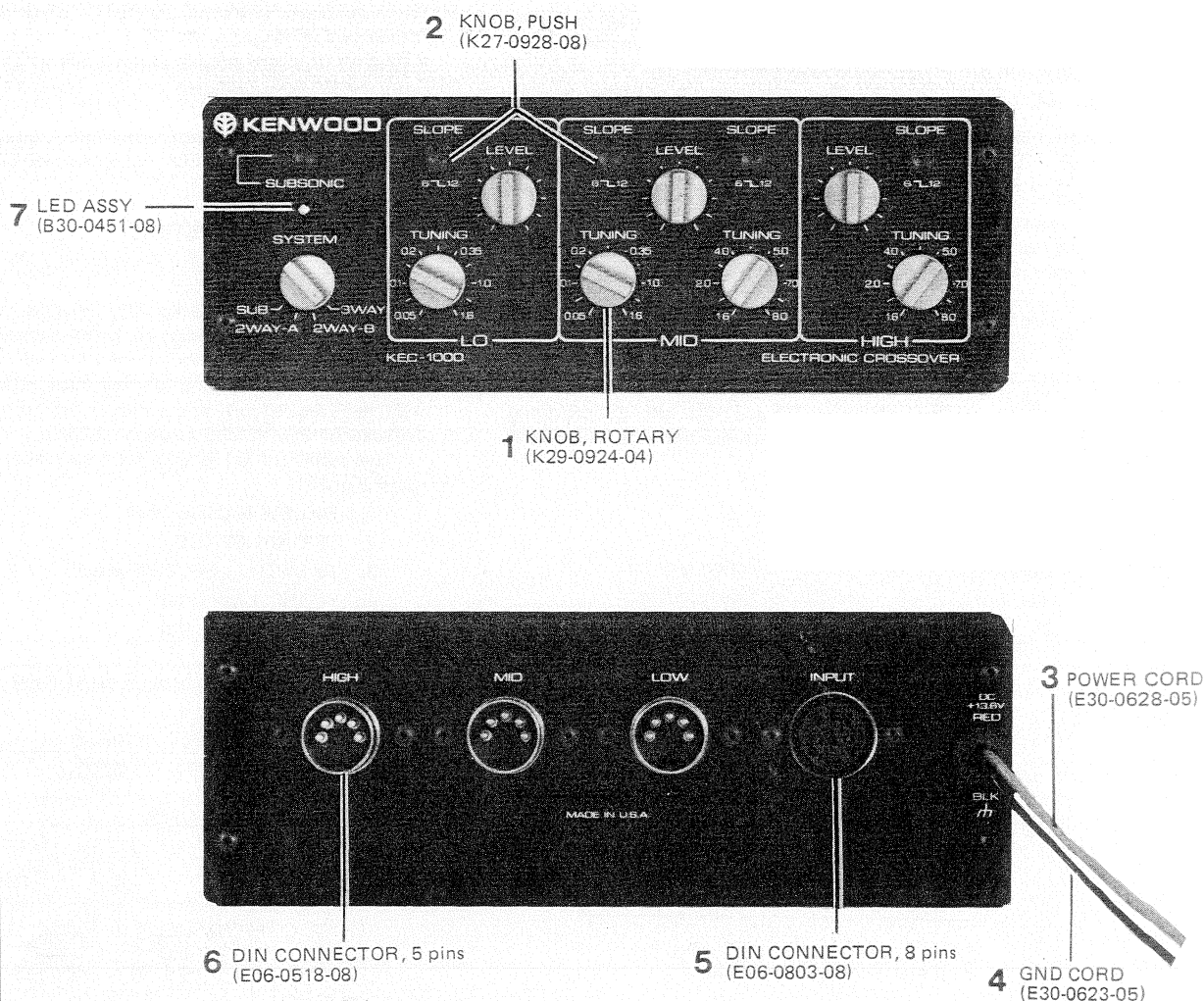




**KENWOOD®**

# KEC-1000

# ELECTRONIC CROSSOVER



## SPECIFICATIONS

INPUT signal level . . . . .	maximum 1V	CROSSOVER POINTS (continuously adjustable)	
Impedance . . . . .	24K ohm	LO . . . . .	50Hz to 1.6kHz
OUTPUT signal level . . . . .	adjustable 0-3V (+10dB)	MID LO . . . . .	50Hz to 1.6kHz
Impedance . . . . .	150 to 275 ohm	MID HI . . . . .	1.6kHz to 8.0kHz
RESPONSE . . . . .	10Hz to 100kHz @ +0/-1.0dB	HI . . . . .	1.6kHz to 8.0kHz
DISTORTION . . . . .	0.006% @ 1kHz/1V	CROSSOVER SLOPE (switchable)	
THD . . . . .	0.04% @ 20Hz-20kHz, 1V output	Filters . . . . .	6dB/octave, 12dB/octave
S/N . . . . .	100dB @ 3V output	POWER . . . . .	+13.8V, 75mA
SUBSONIC filter . . . . .	Frequency = 20Hz (-3dB)	DIMENSIONS . . . . .	(W) 5¼ (H) 2 (D) 3½ inches
	6dB/octave	WEIGHT . . . . .	2 lb

## CIRCUIT DESCRIPTION

**The KEC 1000 is a U.S. designed and manufactured Active Electronic Crossover for automotive use, executed to Professional Audio Standards.**

(For component designations, refer to schematic Page 4.)

## POWER CIRCUIT

The 13.8V (nominal) DC input is coupled through an inline fuse for circuit protection while diode D1 provides protection against damage from power connection reversal.

DC filtration is achieved by inductor L1 and capacitor C1, forming a passive second order low pass filter. A series pass Darlington transistor Q1 is used as power switch, turning on when 12V DC is applied from input connector pin 3, originated by program source equipment. This CONTROL voltage is coupled through a first order low pass filter (R2 and C2) to the base of Q1, here establishing a voltage ramp at the emitter. Upon removal of the control voltage, R1 provides a discharge path for C2.

Capacitor C3 adds DC filtration and energy storage while C4 and C5 contribute localized high frequency power decoupling.

A buffered reference ( $V_R$ ) is derived from the filtered DC power by a voltage divider (R3 and R4) with C6 providing HF decoupling. OpAmp U7 is connected as a unity gain voltage follower for  $V_R$ .

## SYSTEM SELECT

Considerations when system selection is made:

- A. The position of the System Select switch;
- B. The combination of output connectors used.  
(The MID-RANGE OUTPUT is always used.)

### FIG 1: OUTPUT SELECTION

SYSTEM	OUTPUTS		
	LOW	MID	HIGH
SUB	○	○	—
2-A	○	○	—
2-B	—	○	○
3	○	○	○

CIRCLES INDICATE OUTPUT USED IN  
RESPECTIVE SYSTEM MODES.

In the SUB (woofer) mode the two MID filters are bypassed leaving the MID signal unaffected. The LO signal chain feeds the woofers.

### FIG II: ACTIVE FILTERS

FILTER	SYSTEM			
	SUB	2A	2B	3
LOW	○	○	—	○
MID LOW	—	○	—	○
MID HIGH	—	—	○	○
HIGH	—	—	○	○

CIRCLES INDICATE FILTERS USED IN RESPECTIVE SYSTEM MODES.

In 2-WAY A operation, the MID LO filter establishes a crossover match with the LO RANGE filter in the 50 Hz to 1.6kHz tuning range.

2-WAY B selection substitutes the MID HIGH filter, used with the HI RANGE filter and its matching 1.6kHz to 8kHz tuning range.

In the 3-WAY mode both MID filters are used to establish the midrange bandpass of the two crossover points.

## SIGNAL PATH AND FILTERS

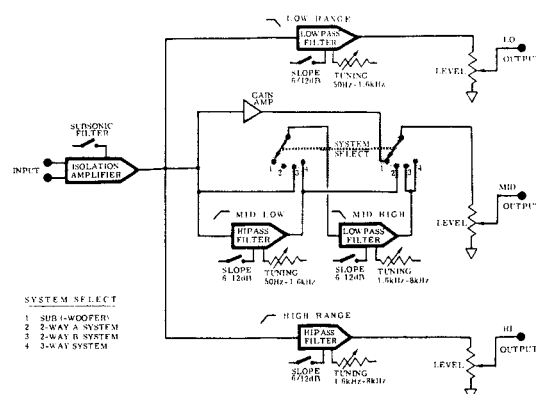
The audio signal is input via connector J1; pin 1 Left, pin 4 Right, and pin 2 Common.

The differential OpAmp U1 provides rejection of unwanted noise which may appear on the input signal lines. The amplifier provides a 4dB voltage gain and combines with a subsonic filter consisting of capacitor C100/C200. When switched into circuit this yields a first order, -6dB/octave highpass filter with -3dB response at 20Hz.

The output of U1 is then split five ways: (see Block Diagram Fig. III).

1. To LOW RANGE filter
2. To GAIN STAGE
3. To SYSTEM SELECT switch
4. To MID LOW filter
5. To HI RANGE filter

FIG III: BLOCK DIAGRAM



With the SLOPE push switches OUT, the filters are first order (-6dB/octave) tunable frequency filters and are followed by IC OpAmps having a 6dB voltage gain. With switches IN, they become Voltage Controlled Voltage Source (VCVS) second order (-12dB/octave) tunable frequency filters, each with a 6dB voltage gain.

Low pass filters (LOW RANGE and MID HI) have a damping ratio of 1.0 to insure low overshoot in transient response. The high pass filters (MID LO and HI RANGE) have a damping ratio of 0.707 (Butterworth) for flatness of response.

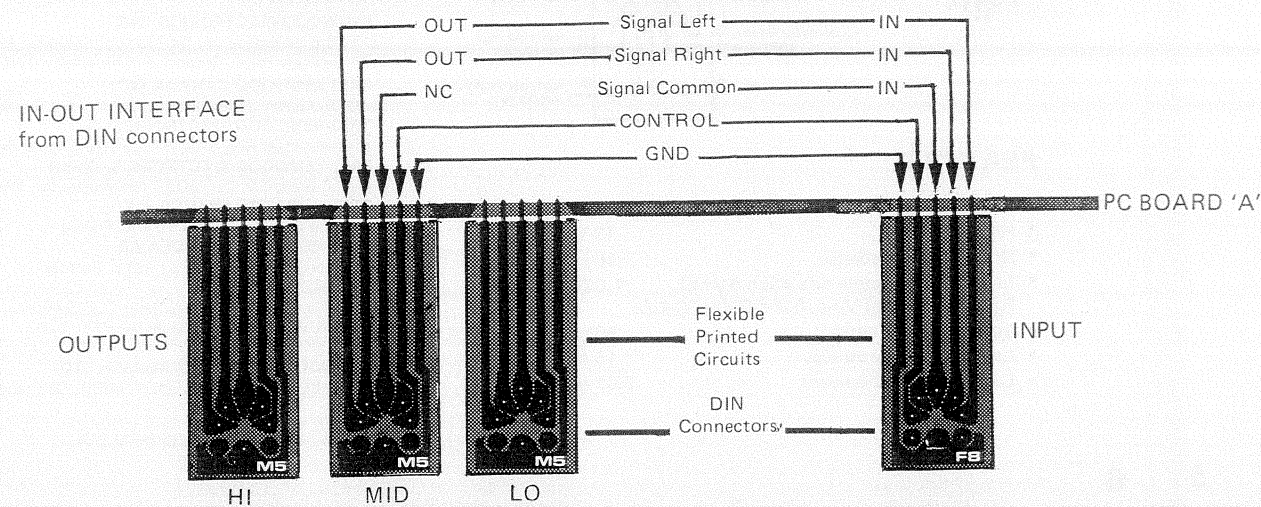
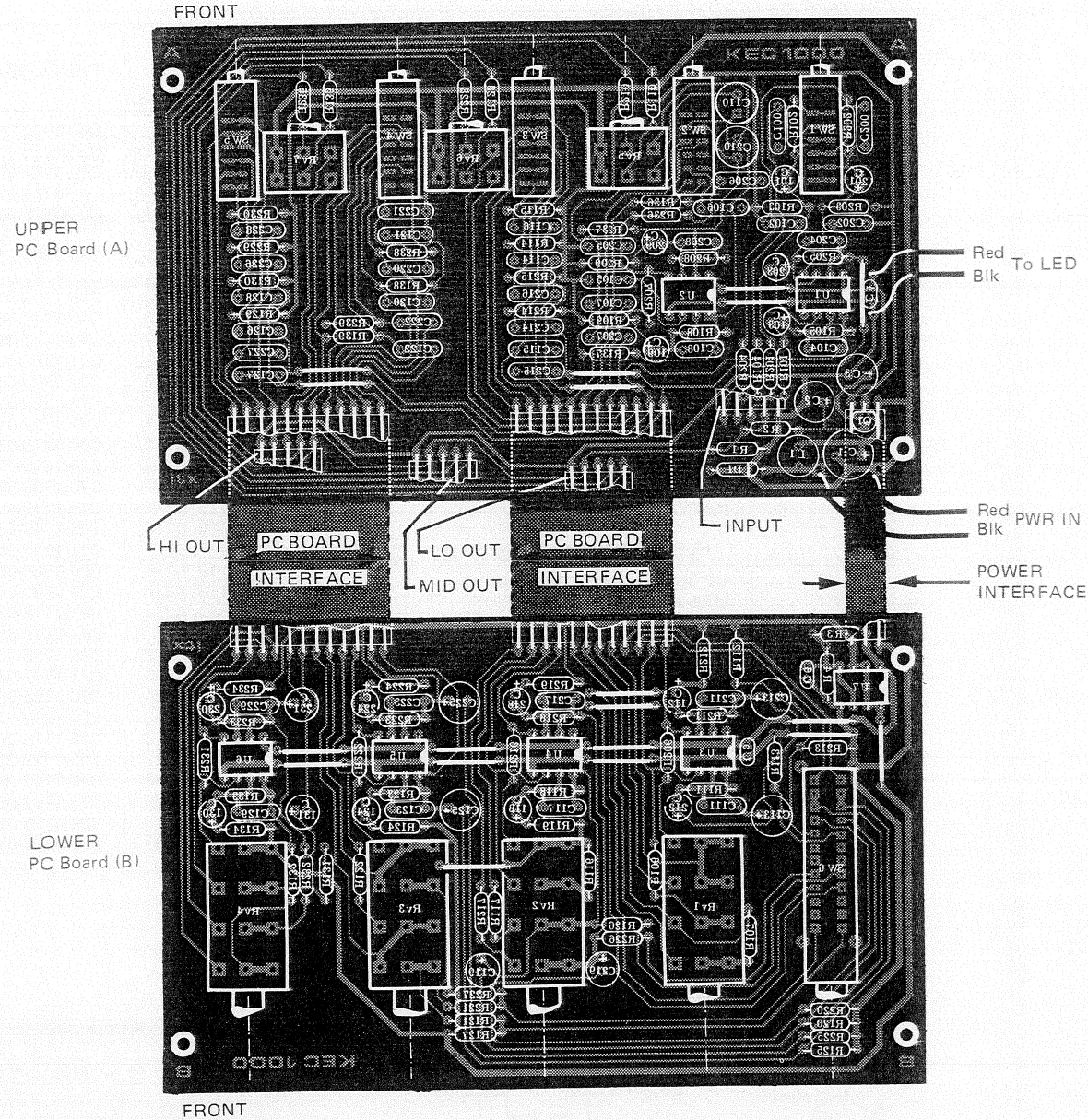
All outputs are capacitively coupled into output level control potentiometers, preceeding respective output connectors.



# KEC-1000

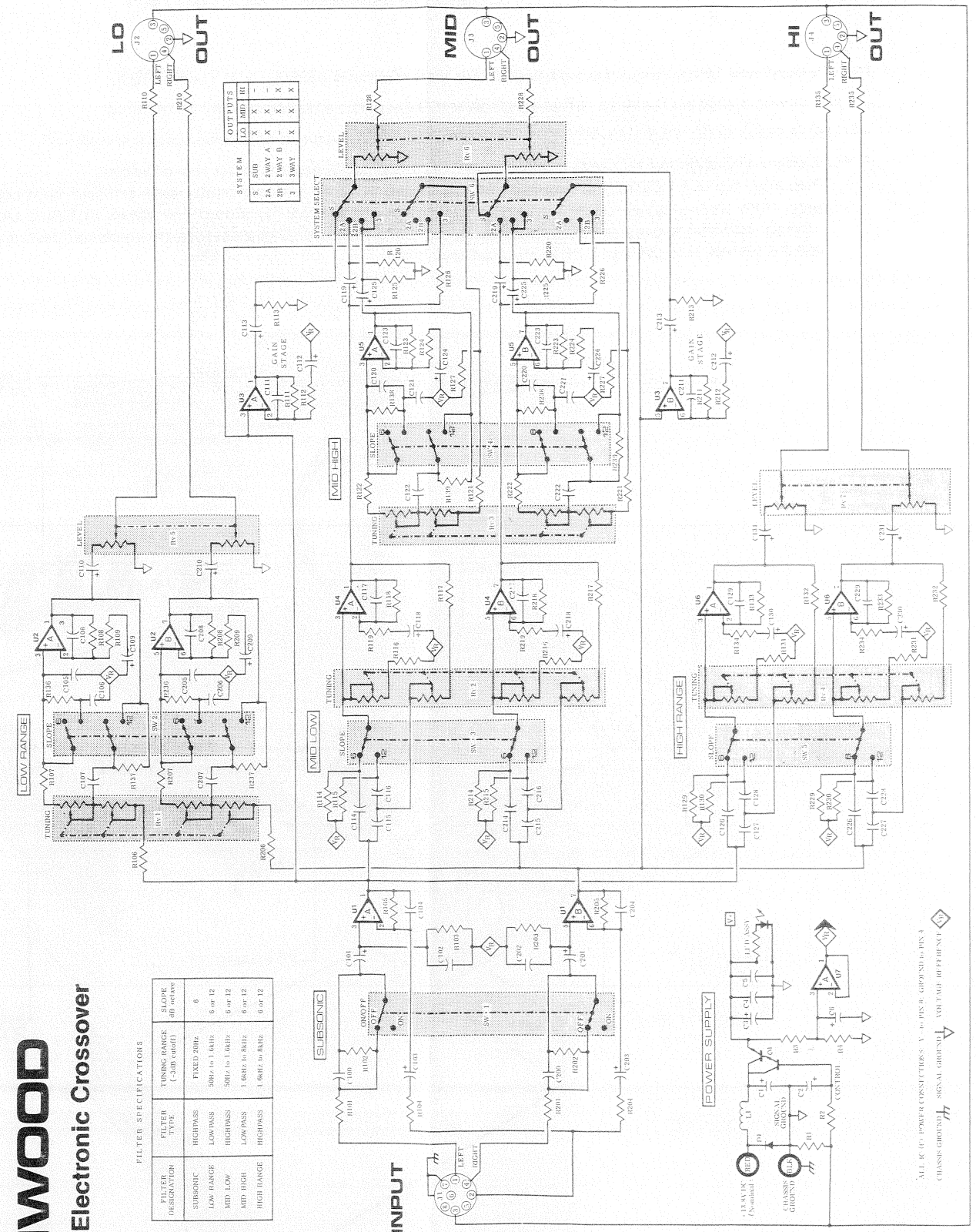
## PC BOARDS

Foil side view. Boards are shown spread apart, joined by interface conductor assemblies.



## SCHEMATIC

# KEC-1000



FILTER SPECIFICATIONS			
FILTER DESIGNATION	FILTER TYPE	TUNING RANGE (C-3dB SLOPE)	SLOPE dB/octave
SUBSONIC	HIGHPASS	FIXED 20Hz	6
LOW RANGE	LOWPASS	50Hz to 1.0kHz	6 or 12
MID LOW	HIGHPASS	50Hz to 1.0kHz	6 or 12
MID HIGH	LOWPASS	1.0kHz to 8kHz	6 or 12
HIGH RANGE	HIGHPASS	1.0kHz to 8kHz	6 or 12

COMPONENT VALUES		
RESISTORS	VALUE	UNIT
R1, R2, R3, R4	10Kohm	
R5, R6, R7, R8	100Kohm	
R9, R10, R11, R12	1Mohm	
R13, R14, R15, R16	15Kohm	
R17, R18, R19, R20	10Kohm	
R21, R22, R23, R24	100Kohm	
R25, R26, R27, R28	1Mohm	
R29, R30, R31, R32	10Kohm	
R33, R34, R35, R36	100Kohm	
R37, R38, R39, R40	1Mohm	
R41, R42, R43, R44	10Kohm	
R45, R46, R47, R48	100Kohm	
R49, R50, R51, R52	1Mohm	
R53, R54, R55, R56	10Kohm	
R57, R58, R59, R60	100Kohm	
R61, R62, R63, R64	1Mohm	
R65, R66, R67, R68	10Kohm	
R69, R70, R71, R72	100Kohm	
R73, R74, R75, R76	1Mohm	
R77, R78, R79, R80	10Kohm	
R81, R82, R83, R84	100Kohm	
R85, R86, R87, R88	1Mohm	
R89, R90, R91, R92	10Kohm	
R93, R94, R95, R96	100Kohm	
R97, R98, R99, R100	1Mohm	
R101, R102, R103, R104	10Kohm	
R105, R106, R107, R108	100Kohm	
R109, R110, R111, R112	1Mohm	
R113, R114, R115, R116	10Kohm	
R117, R118, R119, R120	100Kohm	
R121, R122, R123, R124	1Mohm	
R125, R126, R127, R128	10Kohm	
R129, R130, R131, R132	100Kohm	
R133, R134, R135, R136	1Mohm	
R137, R138, R139, R140	10Kohm	
R141, R142, R143, R144	100Kohm	
R145, R146, R147, R148	1Mohm	
R149, R150, R151, R152	10Kohm	
R153, R154, R155, R156	100Kohm	
R157, R158, R159, R160	1Mohm	
R161, R162, R163, R164	10Kohm	
R165, R166, R167, R168	100Kohm	
R169, R170, R171, R172	1Mohm	
R173, R174, R175, R176	10Kohm	
R177, R178, R179, R180	100Kohm	
R181, R182, R183, R184	1Mohm	
R185, R186, R187, R188	10Kohm	
R189, R190, R191, R192	100Kohm	
R193, R194, R195, R196	1Mohm	
R197, R198, R199, R200	10Kohm	
R201, R202, R203, R204	100Kohm	
R205, R206, R207, R208	1Mohm	
R209, R210, R211, R212	10Kohm	
R213, R214, R215, R216	100Kohm	
R217, R218, R219, R220	1Mohm	
R221, R222, R223, R224	10Kohm	
R225, R226, R227, R228	100Kohm	
R229, R230, R231, R232	1Mohm	
R233, R234, R235, R236	10Kohm	
R237, R238, R239, R240	100Kohm	
R241, R242, R243, R244	1Mohm	
R245, R246, R247, R248	10Kohm	
R249, R250, R251, R252	100Kohm	
R253, R254, R255, R256	1Mohm	
R257, R258, R259, R260	10Kohm	
R261, R262, R263, R264	100Kohm	
R265, R266, R267, R268	1Mohm	
R269, R270, R271, R272	10Kohm	
R273, R274, R275, R276	100Kohm	
R277, R278, R279, R280	1Mohm	
R281, R282, R283, R284	10Kohm	
R285, R286, R287, R288	100Kohm	
R289, R290, R291, R292	1Mohm	
R293, R294, R295, R296	10Kohm	
R297, R298, R299, R300	100Kohm	
R301, R302, R303, R304	1Mohm	
R305, R306, R307, R308	10Kohm	
R309, R310, R311, R312	100Kohm	
R313, R314, R315, R316	1Mohm	
R317, R318, R319, R320	10Kohm	
R321, R322, R323, R324	100Kohm	
R325, R326, R327, R328	1Mohm	
R329, R330, R331, R332	10Kohm	
R333, R334, R335, R336	100Kohm	
R337, R338, R339, R340	1Mohm	
R341, R342, R343, R344	10Kohm	
R345, R346, R347, R348	100Kohm	
R349, R350, R351, R352	1Mohm	
R353, R354, R355, R356	10Kohm	
R357, R358, R359, R360	100Kohm	
R361, R362, R363, R364	1Mohm	
R365, R366, R367, R368	10Kohm	
R369, R370, R371, R372	100Kohm	
R373, R374, R375, R376	1Mohm	
R377, R378, R379, R380	10Kohm	
R381, R382, R383, R384	100Kohm	
R385, R386, R387, R388	1Mohm	
R389, R390, R391, R392	10Kohm	
R393, R394, R395, R396	100Kohm	
R397, R398, R399, R400	1Mohm	
R401, R402, R403, R404	10Kohm	
R405, R406, R407, R408	100Kohm	
R409, R410, R411, R412	1Mohm	
R413, R414, R415, R416	10Kohm	
R417, R418, R419, R420	100Kohm	
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R441, R442, R443, R444	100Kohm	
R445, R446, R447, R448	1Mohm	
R449, R450, R451, R452	10Kohm	
R453, R454, R455, R456	100Kohm	
R457, R458, R459, R460	1Mohm	
R461, R462, R463, R464	10Kohm	
R465, R466, R467, R468	100Kohm	
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R501, R502, R503, R504	100Kohm	
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R521, R522, R523, R524	10Kohm	
R525, R526, R527, R528	100Kohm	
R529, R530, R531, R532	1Mohm	
R533, R534, R535, R536	10Kohm	
R537, R538, R539, R540	100Kohm	
R541, R542, R543, R544	1Mohm	
R545, R546, R547, R548	10Kohm	
R549, R550, R551, R552	100Kohm	
R553, R554, R555, R556	1Mohm	
R557, R558, R559, R560	10Kohm	
R561, R562, R563, R564	100Kohm	
R565, R566, R567, R568	1Mohm	
R569, R570, R571, R572	10Kohm	
R573, R574, R575, R576	100Kohm	
R577, R578, R579, R580	1Mohm	
R581, R582, R583, R584	10Kohm	
R585, R586, R587, R588	100Kohm	
R589, R590, R591, R592	1Mohm	
R593, R594, R595, R596	10Kohm	
R597, R598, R599, R600	100Kohm	
R601, R602, R603, R604	1Mohm	
R605, R606, R607, R608	10Kohm	
R609, R610, R611, R612	100Kohm	
R613, R614, R615, R616	1Mohm	
R617, R618, R619, R620	10Kohm	
R621, R622, R623, R624	100Kohm	
R625, R626, R627, R628	1Mohm	
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R661, R662, R663, R664	1Mohm	
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R669, R670, R671, R672	100Kohm	
R673, R674, R675, R676	1Mohm	
R677, R678, R679, R680	10Kohm	
R681, R682, R683, R684	100Kohm	
R685, R686, R687, R688	1Mohm	
R689, R690, R691, R692	10Kohm	
R693, R694, R695, R696	100Kohm	
R697, R698, R699, R700	1Mohm	
R701, R702, R703, R704	10Kohm	
R705, R706, R707, R708	100Kohm	
R709, R710, R711, R712	1Mohm	
R713, R714, R715, R716	10Kohm	
R717, R718, R719, R720	100Kohm	
R721, R722, R723, R724	1Mohm	
R725, R726, R727, R728	10Kohm	
R729, R730, R731, R732	100Kohm	
R733, R734, R735, R736	1Mohm	
R737, R738, R739, R740	10Kohm	
R741, R742, R743, R744	100Kohm	
R745, R746, R747, R748	1Mohm	
R749, R750, R751, R752	10Kohm	
R753, R754, R755, R756	100Kohm	
R757, R758, R759, R760	1Mohm	
R761, R762, R763, R764	10Kohm	
R765, R766, R767, R768	100Kohm	
R769, R770, R771, R772	1Mohm	
R773, R774, R775, R776	10Kohm	
R777, R778, R779, R780	100Kohm	
R781, R782, R783, R784	1Mohm	
R785, R786, R787, R788	10Kohm	
R789, R790, R791, R792	100Kohm	
R793, R794, R795, R796	1Mohm	
R797, R798, R799, R800	10Kohm	
R801, R802, R803, R804	100Kohm	
R805, R806, R807, R808	1Mohm	
R809, R810, R811, R812	10Kohm	
R813, R814, R815, R816	100Kohm	
R817, R818, R819, R820	1Mohm	
R821, R822, R823, R824	10Kohm	
R825, R826, R827, R828	100Kohm	
R829, R830, R831, R832	1Mohm	
R833, R834, R835, R836	10Kohm	
R837, R838, R839, R840	100Kohm	
R841, R842, R843, R844	1Mohm	
R845, R846, R847, R848	10Kohm	
R849, R850, R851, R852	100Kohm	
R853, R854, R855, R856	1Mohm	
R857, R858, R859, R860	10Kohm	
R861, R862, R863, R864	100Kohm	
R865, R866, R867, R868	1Mohm	
R869, R870, R871, R872	10Kohm	
R873, R874, R875, R876	100Kohm	
R877, R878, R879, R880	1Mohm	
R881, R882, R883, R884	10Kohm	
R885, R886, R887, R888	100Kohm	
R889, R890, R891, R892	1Mohm	
R893, R894, R895, R896	10Kohm	
R897, R898, R899, R900	100Kohm	
R901, R902, R903, R904	1Mohm	
R905, R906, R907, R908	10Kohm	
R909, R910, R911, R912	100Kohm	
R913, R914, R915, R916	1Mohm	
R917, R918, R919, R920	10Kohm	
R921, R922, R923, R924	100Kohm	
R925, R926, R927, R928	1Mohm	
R929, R930, R931, R932	10Kohm	
R933, R934, R935, R936	100Kohm	
R937, R938, R939, R940	1Mohm	
R941, R942, R943, R944	10Kohm	
R945, R946, R947, R948	100Kohm	
R949, R950, R951, R952	1Mohm	
R953, R954, R955, R956	10Kohm	
R957, R958, R959, R960	100Kohm	
R961, R962, R963, R964	1Mohm	
R965, R966, R967, R968	10Kohm	
R969, R970, R971, R972	100Kohm	
R973, R974, R975, R976	1Mohm	
R977, R978, R979, R980	10Kohm	
R981, R982, R983, R984	100Kohm	
R985, R986, R987, R988	1Mohm	
R989, R990, R991, R992	10Kohm	
R993, R994, R995, R996	100Kohm	
R997, R998, R999, R1000	1Mohm	

CAPACITORS		
VALUE	UNIT	TYPE
C1, C2, C3	100uF	10V el.
C4, C5, C6	100uF	10V el.
C7, C8, C9	100uF	10V el.
C10, C11, C12	22uF	10V el.
C13, C14, C15	10uF	10V el.
C16, C17, C18	47uF	10V el.
C19, C20, C21	10uF	10V el.
C22, C23, C24	10uF	10V el.
C25, C26, C27	10uF	10V el.
C28, C29, C30	10uF	10V el.
C31, C32, C33	10uF	10V el.
C34, C35, C36	10uF	10V el.
C37, C38, C39	10uF	10V el.
C40, C41, C42	10uF	10V el.
C43, C44, C45	10uF	10V el.</



# KEC-1000

## DISASSEMBLY FOR REPAIR

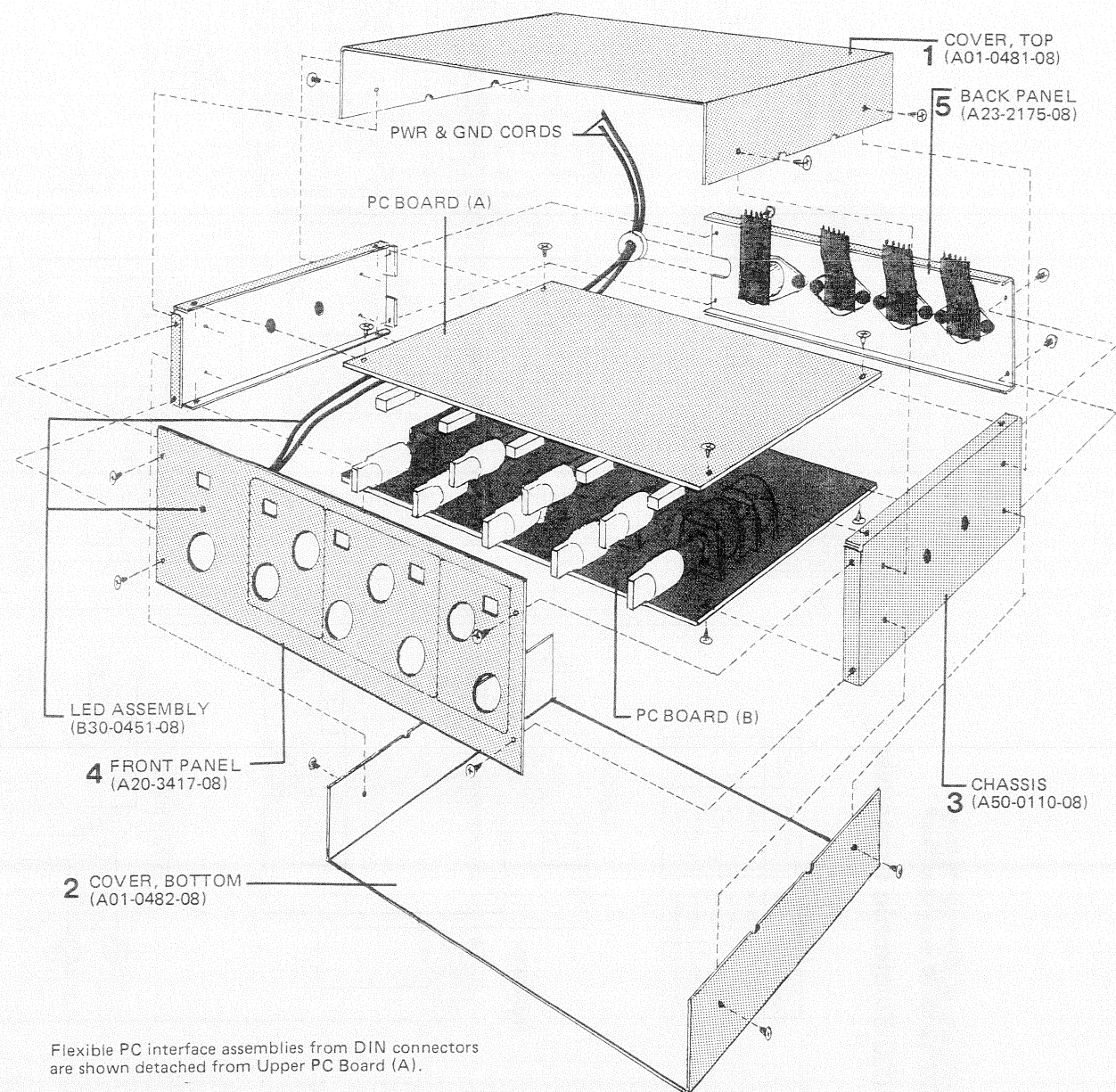
The exploded view below shows the main mechanical parts of the KEC1000.

In most service situations, however, only partial disassembly will be required.

FOR PC BOARD FOIL SIDE ACCESS, remove screws on sides of covers and slip off.

FOR PC BOARD COMPONENT SIDE ACCESS, pull off lower row of knobs.

Thereafter remove LOWER PC BOARD (B) holding screws only and fold front edge of board away from assembly. The board will remain functionally attached to Board (A) via board interface assemblies along rear edge of both PC boards permitting powered testing and service, without further disassembly.



Flexible PC interface assemblies from DIN connectors are shown detached from Upper PC Board (A).

# KEC-1000

## PARTS LIST

Ref. No. page 1, photos, front & back panels

Ref. No. page 4, schematic

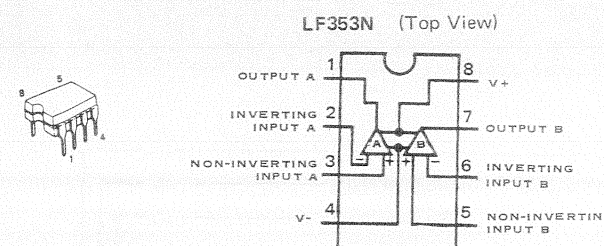
Ref. No. page 5, disassembly drawing

Parts without PARTS NO. are not supplied.

REF. NO.	PARTS NO.	DESCRIPTION
5	1	A01-0481-08 COVER, TOP
5	2	A01-0482-08 COVER, BOTTOM
5	3	A50-0110-08 CHASSIS
5	4	A20-3417-08 FRONT PANEL
5	5	A23-2175-08 BACK PANEL
-	-	J21-3218-08 MOUNTING BRACKET
1	1	K29-0924-04 KNOB, ROTARY
1	2	K27-0928-08 KNOB, PUSH
1	3	E30-0628-05 POWER CORD
1	4	E30-0623-05 GND CORD
-	-	B-50-4631-08 INSTRUCTION MANUAL
-	-	B51-1331-08 SERVICE MANUAL
-	-	H21-0217-08 UNIT CARTON
ELECTRONIC PARTS Ref. page 4		
U1-U7	LF-353-N	DUAL AMP (IC)
Q1	MPS-A13	TRANSISTOR
D1	1N4003	DIODE
LED	B30-0451-08	LED ASSY
L1	L33-0292-08	CHOKE COIL
Rv1-Rv4	R11-4025-08	VAR. RESISTOR 50K $\Omega$ x 4
Rv5-Rv7	R06-0002-08	VAR. RESISTOR 500 $\Omega$ x 2
SW6	S29-4015-08	SWITCH, ROTARY, 4W4P
SW1-SW5	S40-4049-08	SWITCH, PUSH, 2W4P
J1	E06-0803-08	DIN CONNECTOR, 8P
J2-J4	E06-0518-08	DIN CONNECTOR, 5P

REF. NO.	PARTS NO.	DESCRIPTION
C1	C90-0820-05	CAP. 470uf 16V el
C2, C3	C24-1210-77	CAP. 100uf 16V el
C4, C5, C6,	C90-0824-05	CAP. 0.1uf monolithic
C100, C200	C91-0114-05	CAP. 0.33uf mylar
C101, C201	C90-0825-05	CAP. 22uf 16V el
C102, C202	C71-1747-05	CAP. 47pf mica
C103, C203	C90-0825-05	CAP. 22uf 16V el
C104, C204	C71-1747-05	CAP. 47pf mica
C105, C205	C45-1733-36	CAP. 0.033uf mylar
C106, C206	C45-1722-36	CAP. 0.022uf mylar
C107, C207	C45-1727-35	CAP. 0.027uf mylar
C108, C208	C71-1747-05	CAP. 47pf mica
C109, C209	C90-0825-05	CAP. 22uf 16V el
C110, C210	C24-1210-77	CAP. 100uf 16V el
C111, C211	C71-1747-05	CAP. 47pf mica
C112, C212	C90-0825-05	CAP. 22uf 16V el
C113, C213	C24-1210-77	CAP. 100uf 16V el
C114, C214	C45-1768-36	CAP. 0.068uf mylar
C115, C215	C45-1710-45	CAP. 0.1uf mylar
C116, C216	C45-1747-36	CAP. 0.047 mylar
C117, C217	C71-1747-05	CAP. 47pf mica
C118, C218	C90-0825-05	CAP. 22uf 16V el
C119, C219	C90-0822-05	CAP. 47uf 16V el
C120, C220	C91-0115-05	CAP. 0.0015uf mylar
C121, C221	C91-0115-05	CAP. 0.0015uf mylar
C122, C222	C48-1775-15	CAP. 750pf mica
C123, C223	C71-1747-05	CAP. 47pf mica
C124, C224	C90-0825-05	CAP. 22uf 16V el
C125, C225	C24-1210-77	CAP. 100uf 16V el
C126, C226	C46-1718-26	CAP. 0.0018uf mylar
C127, C227	C45-1727-25	CAP. 0.0027uf mylar
C128, C228	C45-1712-26	CAP. 0.0012uf mylar
C129, C229	C71-1747-05	CAP. 47pf mica
C130, C230	C24-0825-05	CAP. 22uf 16V el
C131, C231	C90-0822-05	CAP. 47uf 16V el

## Operational Amplifiers



## FEATURES

- Wide gain bandwidth 4 MHz
- High slew rate 13 V/us
- High input impedance  $10^{12} \Omega$
- Low total harmonic distortion  $A_V=10$ ,  $R_L=10k$ ,  $V_O=20$  Vp-p, BW=20 Hz-20 kHz  $< 0.02\%$
- Low input bias current 50 pA
- Low input noise voltage 16 nV/ $\sqrt{\text{Hz}}$
- Low input noise current 0.01 pA/ $\sqrt{\text{Hz}}$

A product of  
**TRIO-KENWOOD CORPORATION**  
Shionogi Shibuya Building, 17-5, 2-chome Shibuya, Shibuya-ku, Tokyo 150 Japan

**KENWOOD ELECTRONICS, INC.**  
1315 E Watsoncenter Rd. Carson, California 90745, U.S.A.  
75 Seaview Drive, Secaucus, New Jersey 07094, U.S.A.

**TRIO-KENWOOD CANADA INC.**  
1070 Jayson Court Mississauga, Ontario Canada L4W 2V5  
**TRIO-KENWOOD ELECTRONICS, N.V.**

Leuvensesteenweg 504, B-1930 Zaventem, Belgium  
**TRIO-KENWOOD ELECTRONICS, GmbH**  
Rudolf-Braas-Str. 20, 6056 Heusenstamm, West Germany

**TRIO-KENWOOD FRANCE S.A.**  
5, Boulevard Ney, 75018 Paris, France

**TRIO-KENWOOD SVENSKA AB**  
Kemistvagen 10A, 183-21 Tabby, Sweden

**TRIO-KENWOOD AG**  
Unterboesch 6331 Huenenberg/ZUG Switzerland

**TRIO-KENWOOD (AUSTRALIA) PTY. LTD.**  
30 Whiting St., Artarmon, N.S.W. 2064, Australia

**KENWOOD & LEE ELECTRONICS, LTD.**  
Wang Kee Building, 5th Floor, 34-37, Connaught Road Central, Hong Kong